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Department

Aerial Mobile Gateway for Wireless Sensor Networks utilizing drones

Bachelor - September 2014

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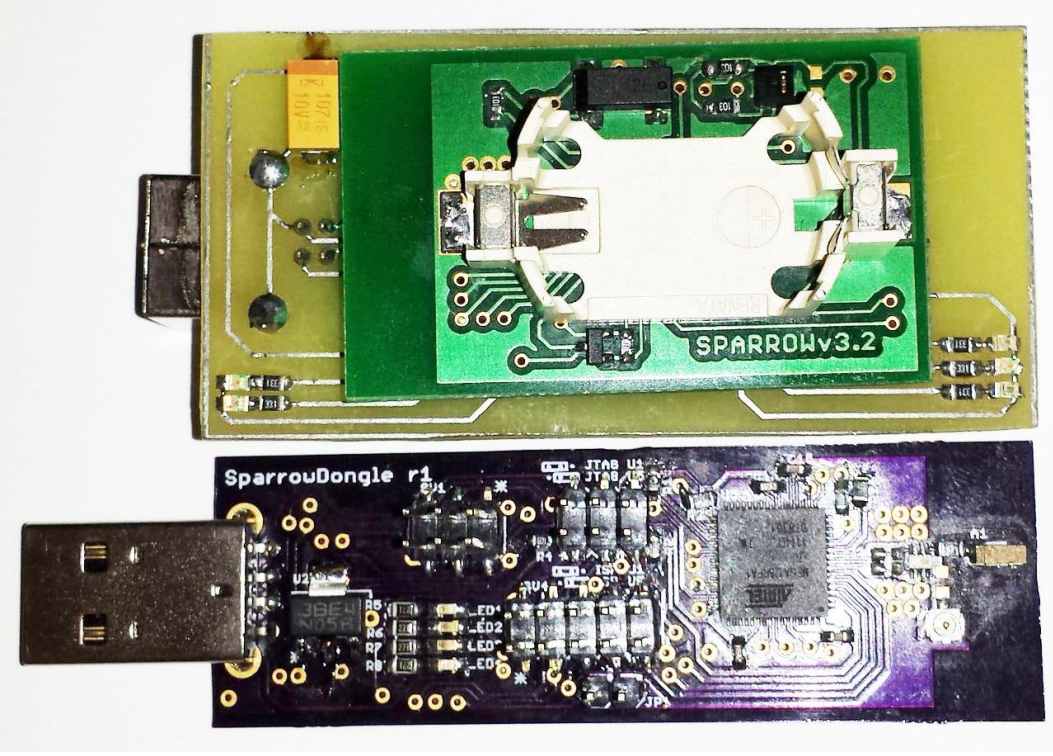
Introduction

- Wireless Sensor Networks
  - small devices
  - wireless communication
  - gather data from environment
  - long battery life

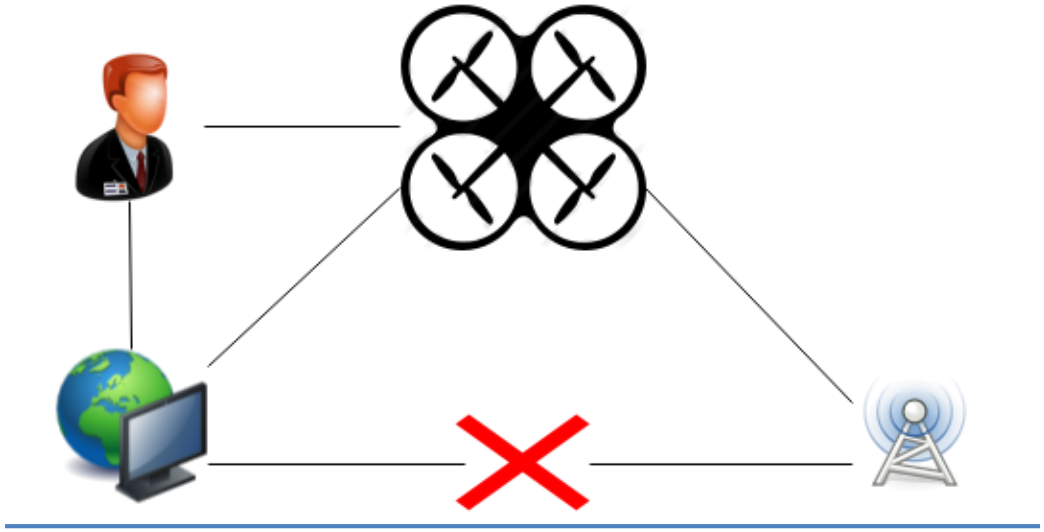
Sparrow Family

- Atmel ATmega32U4 for USB communication
- Atmel ATmega128RFA1 with 2.4 GHz transceiver



Why?

- Location of the network
- Rapid deployment
- Dynamic environment



Parrot AR.DRONE 2.0

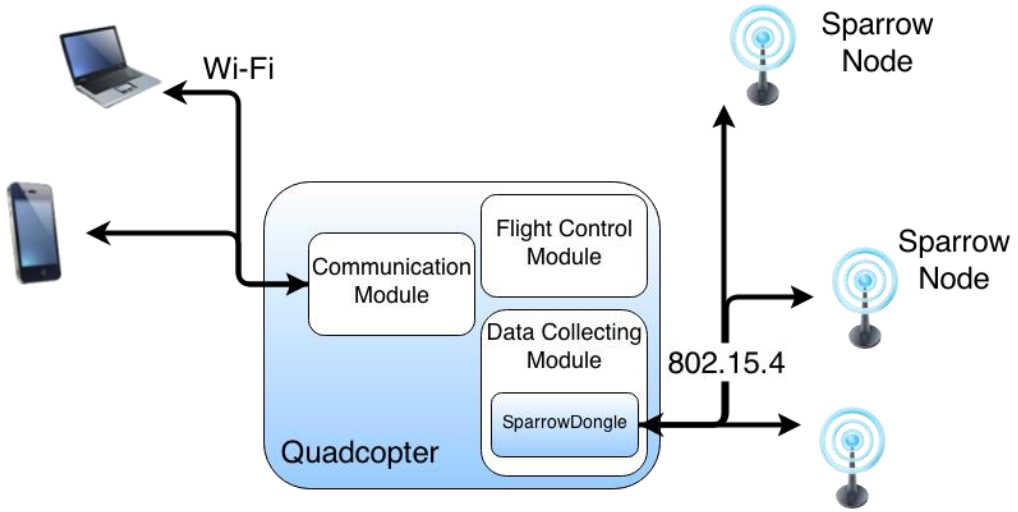
- Linux
- USB 2.0
- Wi-Fi
- 1GHz ARM V8

Features

- Ease of interaction
- Proximity function
- Energy Saving
- Latest Data always saved
- Fault Tolerance

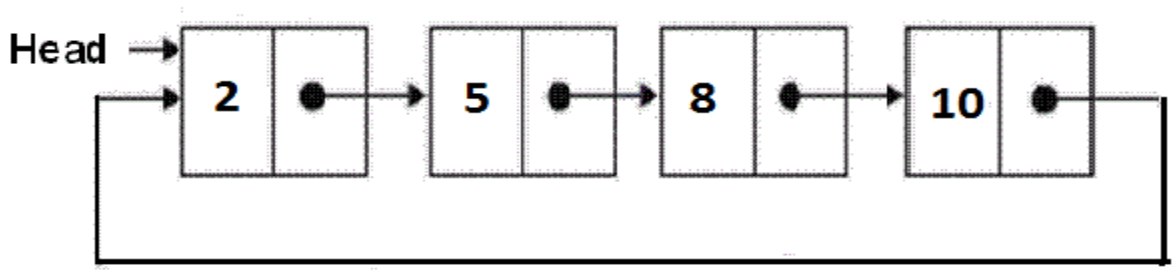
System Architecture

- Sparrow Module
- Data Collecting Module
- Communication Module
- Android Application



Sparrow Module

- Handles node communication
- Saves data in a circular list
- Replaces the oldest data with new data



Data Collecting Module

- Detects the presence of a gateway
- Saves the data received from the gateway into files
- File name composed of timestamp and node id
- Parses the data to obtain node information

Communication Module

- Creates JSON object with the nodes information
- Sends the object through port 8888
- Listens for new connection if current one is lost

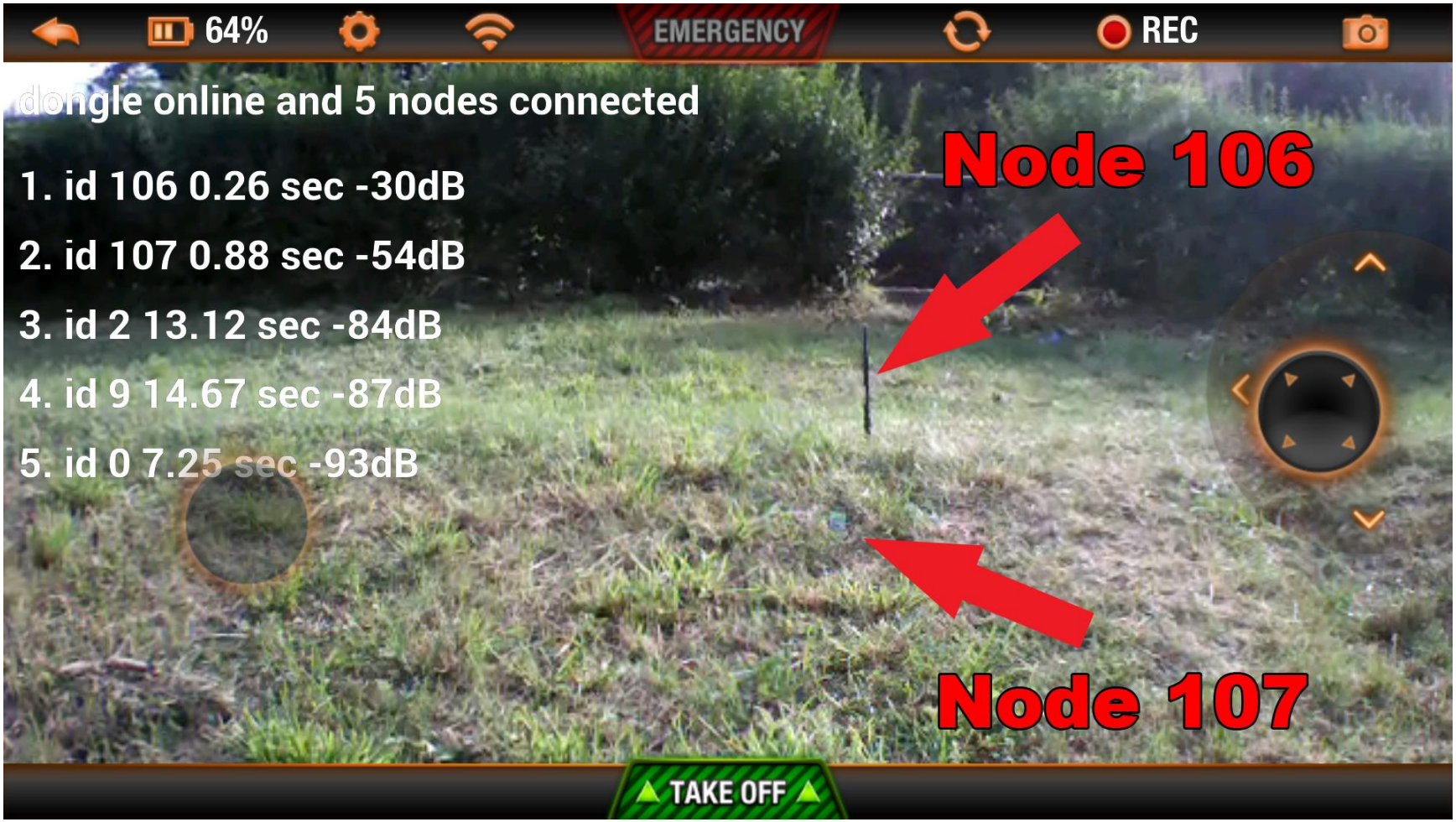
Drone Modifications

- Added USB CDC ACM kernel module
- FTP server on port 4242 for data download
- Carved hull
- External antenna mounted
- Counter weight for stability

AR Drone SDK 2.0.1

- Modified Android version of FreeFlight 2.0 from AR Drone SDK 2.0.1
- Added option to locally download data on the phone
- Modified Piloting zone of the application

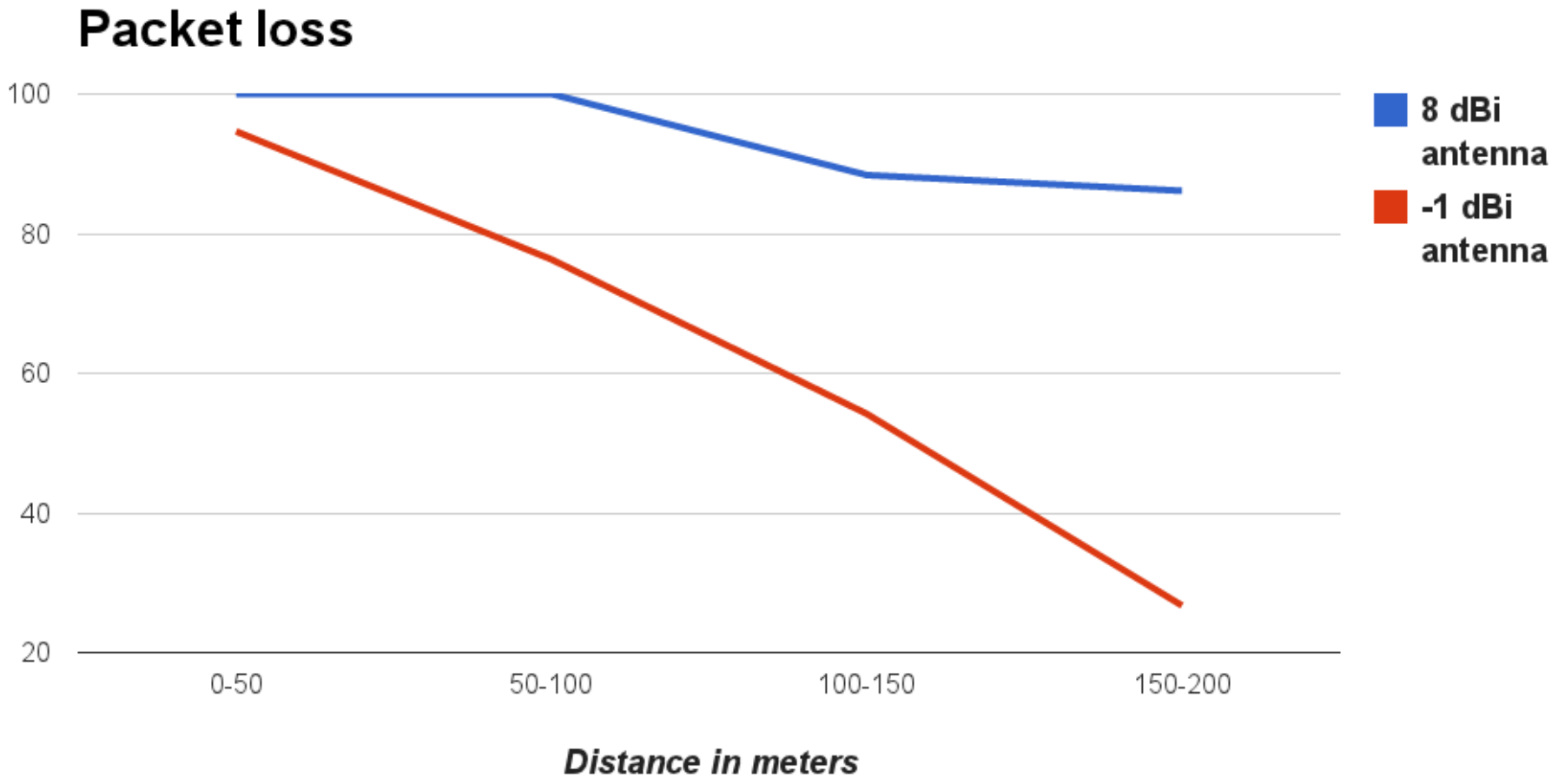
Piloting Zone



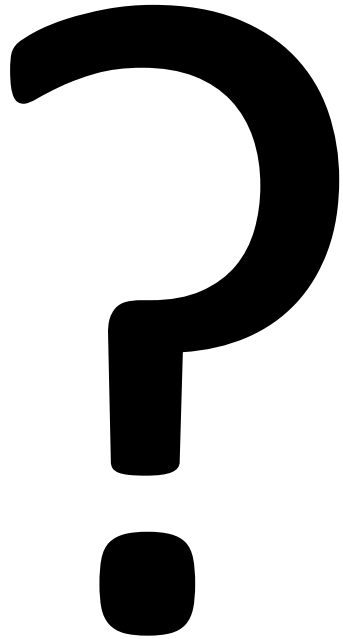
Results

- All data saved successfully
- Communication distance - 300 meters with external 8dBi antenna and clear line of sight
- Stability – affected by the modifications
- Packet Loss
  - small for an external 8dBi antenna
  - high for a small -1 dBi SMD antenna

Packet loss


Packet loss
100
80
60
40
20
0-50
50-100
100-150
150-200
Distance in meters
8 dBi antenna
-1 dBi antenna

Conclusions

- System is functional – drone successfully deployed in gathering data from remote WSN
- Good transmission distance – up to 300 meters
- A WSN deployed in a wide area can be serviced with a single drone
- Simple to use

Questions